Amendments to the Drawings:

The attached replacement sheets of drawings replace the original drawings to correct informalities raised by the Examiner. No new matter is added.

REMARKS

This response corrects minor clerical informalities with regard to the claim identifiers set forth in the claim amendments in the prior response filed February 2, 2006 and is filed here to supersede the prior response.

This application has been amended to fully address and resolve each of objections and rejections raised in the Office Action. Reconsideration is respectfully requested.

Drawings have been amended to remove the informalities caused by the shadows in the original drawings. Claims 7, 20 and 27 have been amended to clarify the language and to overcome the rejections. No new matter is added.

Claims 7, 17, 19, 20, 26 and 27 stand rejected under 35 USC §101 as allegedly being directed to non-statutory subject matter. This contention, however, is respectfully traversed.

Claims 7, 17, 19, 20, 26 and 27 recite methods and systems for measuring curvatures of layered structures having embedded line features and computing stresses of the embedded line features. As explicitly described in the original specification, such methods and systems have practical applications that produce useful, concrete and tangible results. For example, paragraphs [0004] and [0005] provide the following:

> *[0004] Hence, the interfacing of different materials and different structures may cause a complex stress state in each device feature due to differences in the material properties, e.g., either or both of mechanical and thermal properties. A complex stress state may also be present in the structure at interconnections subject to various fabrication conditions and environmental factors (e.g., variations or fluctuations in temperature). In fabrication of an integrated circuit, for example, the stress state of the interconnect conducting lines may be affected by processing steps such as film deposition, thermal cycling, chemical-mechanical polishing (CMP) or other layer thinning processes, and by passivation capping or*

encapsulation. Stresses caused by these and other factors may adversely affect the integrity or effectiveness of subsequent processing steps, or the performance and reliability of the devices. Such stresses may even cause failure of the component or device under action of such stresses.

[0005] For at least these reasons, it may be desirable to analyze, measure and monitor stresses, changes in stresses, and stress accumulation history and stress budget of a substrate and of features fabricated on the substrate. For example, stresses on various features formed on the substrate may be analyzed to improve the design of the device structure, selection of materials, fabrication processes, and other aspects of the devices so that the yield, device performance, and device reliability can be enhanced. The stress measurements may be used to assess or evaluate the reliability of materials against failures from such phenomena as stress migration, stress-induced voiding in features such as metal lines and vias, dielectric cracking, delamination, hillock formation, and electromigration. The stress measurements may also be used to facilitate quality control of the mechanical integrity and electromechanical functioning of circuit chip dies during large scale production in wafer fabrication facilities. In addition, the stress measurements may be used to improve the designs of various fabrication processes and techniques, such as thermal treatments (e.g., temperature excursions during passivation, annealing, or curing) and chemical and mechanical treatments (e.g., polishing or thinning) to reduce residual stresses in the completed components or devices.

In view of the above, the rejections under 35 USC §101 are improper and must be withdrawn.

Claims 7, 17, 19, 20, 26 and 27 also stand rejected under 35 USC §102(b) as allegedly being anticipated by a published PCT application no. WO 01/82335A2. Such rejections must be withdrawn for at least the following reasons.

Referring to Claim 7 as amended, for example, Claim 7 in its amended form now recites using analytical expressions to

compute local stresses in the line feature from a first contribution based on the local curvature information and a second, separate contribution based on the local temperature information. Support for this aspect of Claim 7 as amended can be found in the original specification of this application, e.g., equations and description from page 13 through page 20. Paragraph [0036] beginning at line 11 on page 19 specifically describes the two different contributions to the stresses:

> *The above changes in the stress components σ_{33}^{1} and σ_{11}^{1} include two different contributions. One contribution is related to changes in both components of the local curvature and the other is proportional to temperature deviation, ΔT, from a reference state (e.g., an initial, stress-free stress state such as cooling from an anneal or from passivation). The curvature-dependent contribution represents the effect of thermal mismatches, e.g., the thermal mismatch between the embedded line feature and the substrate, and the thermal mismatch between the encapsulating or passivating material and the substrate. This contribution is an external contribution to stresses and can be calculated from curvature information. The second part represents the effect of thermal mismatch between two phases in the film structure (i.e. between metal lines and their encapsulating or passivating low-k dielectric material surrounding the metal lines). This second contribution is self-equilibrated and does not produce a change in curvature. Hence, this second contribution represents an intrinsic thermal contribution to stresses. The stress tensor component σ_{22}^{1}, which is the stress component perpendicular to the line feature within the layer, has only the external contribution and thus depends on the local curvature only and does not have a dependence on the local temperature.*

The cited PCT application no. WO 01/82335A2 discloses a contribution from the local curvature of the substrate in Equation (1) on page 20 and relations between the local curvature components (k1 and k2) and the temperature change ΔT in Equations (5) and (6) on page 30. This contribution,

although being related to the local temperature change, is caused by the local curvatures and does not include the recited second, separate contribution based on the local temperature in Claim 7 as amended. Hence, the cited PCT application no. WO 01/82335A2 fails to disclose the above aspect of Claim 7 regarding the second, separate contribution based on the local temperature information.

Therefore, Claim 7 as amended is patentable.

In supporting the above rejection, the Office Action contends that the description regarding the yield temperature on pages 37 and 38 in the cited PCT application no. WO 01/82335A2 discloses the "obtaining local temperature information in the area o the line feature" (Office Action, page 7). The Office Action further points to the relations between the local curvature components (k1 and k2) and the temperature change ΔT in Equations (5) and (6) on page 30 of the cited PCT application no. WO 01/82335A2 as evidence to show teaching of the recited "local temperature information of the line feature" in Claim 7. This contention appears to be based on an incorrect reading of the cited PCT application no. WO 01/82335A2 because, technically speaking, the yield temperature on pages 37 and 38 in the cited PCT application no. WO 01/82335A2 has nothing to do with the relations between the local curvature components (k1 and k2) and the temperature change ΔT in Equations (5) and (6) on page 30. Notably, the relations between the local curvature components (k1 and k2) and the temperature change ΔT in Equations (5) and (6) on page 30 are for temperature ranges within the elastic range of the layered structure and, notably, below the yield temperature.

Therefore, the rejections lack support from the cited PCT application no. WO 01/82335A2. Accordingly, the rejections must be withdrawn.

In view of the above, Claim 7 as amended is distinctly patentable under 35 USC §102(b) and should be allowed.

Other rejected claims are patentable and should be allowed based on at least the above reasons made for Claim 7.

In addition, Claims 8-16 and 18 are dependent claims of Claim 7; Claims 21-25 are dependent claims of Claim 20; and Claims 28-31 are dependent claims of Claim 27. Hence, these dependent claims are also patentable and allowable.

It is believed that all of the issues raised by the examiner have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

Please apply any applicable charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: May 14, 2007

Scott C. Harris
Reg. No. 32,030
By Bing Ai
Reg. No. 43,312

Fish & Richardson P.C.
PTO Customer No. 20985
(858) 678-5070 telephone
(858) 678-5099 facsimile
10736024.doc